Neural Control of Movement
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E-13. Motor Preparation and Settling Activity in PMd.

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Much work has focused on the role of sensory feedback and internal models in optimizing control signals during movement. Here we explore the possibility that the optimization of control signals begins during motor preparation. We recorded preparatory neural activity from dorsal premotor cortex (PMd) using a delayed-reach paradigm. We assumed that rapid movements are in large part the product of a motor 'program' latent in such preparatory activity. If so, it would seem critical that the brain optimize preparatory activity, so as to achieve the desired result when the movement is triggered. To look for evidence of such optimization, we examined the across-trial variability of firing rates. Our hypothesis was that, before target onset (before optimization begins), firing rates would likely be variable. However, as optimization completes, firing rates would become more consistent, assuming the range of 'optimal' states is limited. We did in fact find that the across-trial variability of PMd firing rates declined following target onset (24%,19% and 20% for three monkeys, $p<0.1$). Microstimulation of M1 had little effect on RT (12 and 32 sites, +4 and +2 ms, $p>0.1$). The effect is thus specific with respect to area and movement modality. Microstimulation delivered to PMd >100 ms before the go cue had only a slight effect on RT (+7 and +2 ms), consistent with estimates of the time-course of motor preparation provided by the variability analysis above. Lastly, microstimulation just before the go cue delayed RT, but only if the delay-period was long enough. *Support: Helen Hay Whitney, NIH, BWF, NSF, ONR, Sloan, Whitaker.*